



RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

PTF Vessel Vent Caustic Scrubber

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

Content applicable to ALARA? Yes No

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Rev
1

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| Quality Level |
| Q |
| DOE Contract No. DE-AC27-01RV14136 |

NOTE: Contents of this document are Dangerous Waste Permit affecting.

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|-----|----------|-------------------------------------|-------------------------|-------------------------------|-----------------------------------|----------|---------------------------|
| 2 | 6/24/09 | J Czarniecki <i>J Czarniecki</i> | M Seed <i>M Seed</i> | B Makadia <i>B Makadia</i> | B Erlandson <i>B Erlandson</i> | N/A | J Julyk <i>J Julyk</i> |
| 1 | 07/24/06 | D Rickettson | L Donovan | B Makadia | J Hendricks | W Dey | J Julyk |
| 0 | 07/24/03 | Kar Wei Chin | N Sentanu | C Morley | N/A | G Warner | M Hoffman for G Duncan |

SPECIFICATION No.
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Rev
2

Revision History

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| 0 | Issued for Purchase |
| 1 | Incorporated SCN's, 24590-PTF-3PN-MKAS-00001, 24590-PTF-3PN-MKAS-00002, & 24590-PTF-3PN-MKAS-00003. Added ANSI / AISC N690 NDE for ring beam, specifications for lateral restraint and Seismic Anchor Motions (SAM). Added Specification for Pressure Vessel Fatigue Analysis. |
| 2 | Administrative update to source document to incorporate outstanding changes and supersede permit document no longer required by Project. Incorporated 24590-PTF-3PN-MKAS-00004. Supersedes 24590-PTF-3PS-MKAS-TP001, Rev 1. |

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1 Scope

1.1 Project Description and Location

The Hanford Tank Waste Treatment and Immobilization Plant (WTP) is a complex of waste treatment facilities where the US Department of Energy (DOE) Hanford Site tank waste will be pretreated and immobilized into a stable glass form via vitrification. The WTP contractor will design, build, and start up the WTP pretreatment and vitrification facilities for the DOE Office of River Protection (ORP).

The Hanford Site occupies an area of about 560 square miles along the Columbia River, north of Richland, WA in the USA. The WTP facilities will be constructed at the 200 East Area of the Hanford Site. The site elevation varies from 662 feet to 684 feet above mean sea level.

1.2 Equipment, Material, and Services Required

This specification establishes the minimum requirements for the performance, design, analysis, materials, fabrication, testing, inspection, quality assurance (QA), qualification, documentation, and preparation for shipment of the Vessel Vent Caustic Scrubber, plant item number 24590-PTF-MK-PVP-SCB-00002, for use in the WTP Pretreatment Facility (PTF).

The scope of work for the Seller includes all work specifically defined in this specification and its addenda and attachments. Work shall include, but shall not be limited to the following:

- 1.2.1 Provide design, materials, fabrication, testing, inspection, preparation for shipment, documentation, and submittals of a Vessel Vent Caustic Scrubber, plant item number 24590-PTF-MK-PVP-SCB-00002 in accordance with this specification, its addenda and attachments, material requisition # 24590-QL-MRA-MKAS-00002, and referenced codes, standards and Buyer documents.
- 1.2.2 Provide written (process, mechanical and hydraulic) guarantee that all equipment and components supplied by the Seller shall perform to the requirements of this specification, material requisition # 24590-QL-MRA-MKAS-00002, and referenced codes, standards and Buyer documents.
- 1.2.3 Perform the NDE for the ring beam as specified on the Mechanical Data Sheet, 24590-PTF-MKD-PVP-00002.
- 1.2.4 Provide design, materials, fabrication, testing, inspection, preparation for shipping, documentation, and submittals for the Vessel Vent Caustic Scrubber lateral restraint.
- 1.2.5 Provide Seismic Anchor Motion (SAM) for each vessel nozzle.

1.3 Work by Others

Any item not specifically listed as being supplied by the Buyer shall be provided by the Seller. The Buyer shall supply the following:

- 1.3.1 Shipping of the Vessel Vent Caustic Scrubber.

- 1.3.2 Unloading, storage and installation labor of all materials and equipment at the Buyer's job-site.
- 1.3.3 Supply and installation of instrumentation and controls.
- 1.3.4 The Buyer is responsible for the design of the ring beam for the vessel support.
- 1.3.5 Embeds will be provided at elevation 41'-6" for the lateral restraint.
- 1.3.6 Field welding of the lateral restraint to the embed plates at elevation 41'-6".

1.4 Acronyms, Abbreviations and Definitions

1.4.1 Acronyms and Abbreviations

| | |
|-----------------|---|
| APC | Additional Protection Class |
| ASME | American Society of Mechanical Engineers |
| DBE | Design Basis Earthquake |
| DF | Decontamination Factor |
| DOE | US Department of Energy |
| HEME | High Efficiency Mist Eliminator |
| ITS | Important to Safety |
| MDS | Mechanical Data Sheet |
| MR | Material Requisition |
| MSDS | Material Safety Data Sheet |
| NO _x | Nitrogen Oxides |
| ORP | Office of River Protection |
| PTF | Pretreatment Facility |
| PVP | Pretreatment Vessel Vent Process System |
| QA | Quality Assurance |
| QAP | Quality Assurance Program |
| QL | Quality Level |
| SC | Safety Class |
| SDC | Safety Design Class |
| SDS | Safety Design Significant |
| SS | Safety Significant |
| SSC | System, Structure, and Component |
| WG | Water Gauge |
| WTP | Hanford Tank Waste Treatment and Immobilization Plant |

1.4.2 Quality Level (Q)

The quality level identifies the quality requirements to be applied to the equipment. The identified quality levels are Q, and CM (Commercial). Quality requirements are specifically defined on the associated mechanical data sheets (MDSs) and supplier quality assurance program (QAP) requirements data sheets.

1.4.3 Seismic Category (SC)

Specific requirements for each seismic category are defined in reference documents listed in section 2.3 of this specification.

1.4.4 Other Definitions

Black Cell (R5-C5): Is a sealed concrete structure containing very high radiation and contamination where human access is normally prohibited during the normal operating lifetime of the cell and maintenance is generally not performed in the cell.

C5: Contamination classification for plant areas that are considered high contamination areas. Access to C5 areas is not normally permitted.

Decontamination Factor (DF): Equals the ratio of the concentration of a component in the inlet gas versus the concentration of the same component in the outlet gas.

Design Basis Earthquake (DBE): A specification of the ground motion at the site. For the WTP site, the DBE is defined by horizontal and vertical acceleration response spectra; refer to section 2 of the MR for the attached In-Structure Acceleration Response Spectra.

Important to Safety (ITS): Systems, structures, and components (SSCs) that serve to provide reasonable assurance that the facility can be operated without undue risk to the health and safety of the workers and the public. ITS encompasses the broad class of facility features addressed (not necessarily explicitly) in the top-level radiological, nuclear, and process safety standards and principles that contribute to the safe operation and protection of workers and the public during all phases and aspects of facility operations (i.e., normal operation as well as accident mitigation). ITS includes SSCs designated as Safety Design Class (SDC) / Safety Class (SC), Safety Design Significant (SDS) / Safety Significant (SS), and Risk Reduction Class (RRC) / Additional Protection Class (APC).

MDS: Refers to the mechanical data sheet for the Vessel Vent Caustic Scrubber, Buyer document number 24590-PTF-MKD-PVP-00002.

MR: Refers to the material requisition for the Vessel Vent Caustic Scrubber, Buyer document number 24590-QL-MRA-MKAS-00002.

R5: Radiation classification for areas considered to be high or very high radiation areas.

Scrubber: Refers to the PTF Vessel Vent Caustic Scrubber, plant item number 24590-PTF-MK-PVP-SCB-00002.

1.5 Safety/Quality Classifications

Refer to the MDS for the quality level and seismic category designations of the Scrubber.

2 Applicable Documents

2.1 General

2.1.1 Work shall be done in accordance with the referenced codes, standards, and documents listed below, which are an integral part of this specification.

- 2.1.2 When specific chapters, sections, parts, or paragraphs are listed following a code, industry standard, or reference document, only those chapters, sections, parts, or paragraphs of the document are applicable and shall be applied. If a date or revision is not listed in section 2, the latest issue, including addenda, at the time of Request for Quote shall apply. The dates and revisions listed in section 2 shall apply to subsequent references to codes and standards within this specification. When more than one code, standard, or referenced document covers the same topic, the requirements for all must be met with the most stringent governing.

2.2 Codes and Standards

- 2.2.1 ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*.
- 2.2.2 ASME AG-1-1997 Article AA, *Code on Nuclear Air and Gas Treatment*.
- 2.2.3 ASME-NQA-1-1989, *Quality Assurance Program Requirements for Nuclear Facilities*.
- 2.2.4 10 CFR 835, *Occupational Radiation Protection*.
- 2.2.5 ANSI/AISC N690-1994* *Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities*.
* This standard is tailored in Appendix C of the Safety Requirements Document (SRD) (2.3.22). Engineering Specification is in accordance with the tailoring in Appendix C.

2.3 Reference Documents/Drawings

- 2.3.1 24590-PTF-MKD-PVP-00002, *Mechanical Data Sheet for the PTF Vessel Vent Caustic Scrubber*.
- 2.3.2 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.
- 2.3.3 24590-WTP-3PS-G000-T0002, *Engineering Specification for Positive Material Identification (PMI) for Shop Fabrication*.
- 2.3.4 24590-WTP-3PS-G000-T0003, *Engineering Specification for Packaging, Handling and Storage Requirements*.
- 2.3.5 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*.
- 2.3.6 24590-WTP-3PS-MV00-T0002, *Engineering Specification for Seismic Qualification Criteria for Pressure Vessels*.
- 2.3.7 24590-WTP-3PS-MVB2-T0001, *Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers*.
- 2.3.8 24590-WTP-3PS-SS00-T0002, *Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*.
- 2.3.9 24590-WTP-MV-M59T-00001, *Pressure Vessel Tolerances Standard Details*.

- 2.3.10 24590-WTP-MV-M59T-00007, *Thermowell Connection Standard Details*.
- 2.3.11 24590-WTP-MV-M59T-00009, *Lifting Lugs Standard Details*.
- 2.3.12 24590-WTP-MV-M59T-00010, *Tailing Lug Standard Details*.
- 2.3.13 24590-WTP-MV-M59T-00012, *Grounding Lug Standard Details*.
- 2.3.14 24590-WTP-MV-M59T-00016001, *Vessel Connections Standard Details Sheet 1 of 3*.
- 2.3.15 24590-WTP-MV-M59T-00016002, *Vessel Connections Standard Details Sheet 2 of 3*.
- 2.3.16 Deleted
- 2.3.17 24590-WTP-MV-M59T-00018, *Vessel Name Plate Standard Details*.
- 2.3.18 24590-WTP-PW-P30T-00001, *WTP End Prep Detail for Field Butt Welds*.
- 2.3.19 24590-WTP-3PS-SS90-T0001, *Engineering Specification for Seismic Qualification of Seismic Category I/ II Equipment and tanks*.
- 2.3.20 24590-WTP-DC-ST-01-001, *Structural Design Criteria*.
- 2.3.21 24590-WTP-DC-ST-04-001, *Seismic Analysis and Design Criteria*.
- 2.3.22 24590-WTP-SRD-ESH-01-001-02, *Safety Requirements Document, Volume II*
- 2.3.23 24590-WTP-3PS-MV00-T0003, *Engineering Specification for Pressure Vessel Fatigue Analysis*.

3 Design Requirements

3.1 General

- 3.1.1 As Low As Reasonably Achievable (ALARA) principles shall be applied to the design of the Scrubber per 10 CFR 835, *Occupational Radiation Protection*.
- 3.1.2 Seller shall design the Scrubber to the requirements of
 - this specification
 - applicable codes, standards and documents in section 2 of this specification
 - Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*
 - ASME AG-1-1997 Article AA-4000, *Code on Nuclear Air and Gas Treatment*
 - the MDS (mechanical data sheet # 24590-PTF-MKD-PVP-00002)
 - the MR (material requisition # 24590-QL-MRA-MKAS-00002)
- 3.1.3 The Scrubber, including the packed section and dry packing section, shall be designed to operate continuously for a minimum service life of 40 years without access for maintenance. Seller shall provide documentation, including but not limited to calculations and analyses, to support their design and performance of the equipment.

- 3.1.4 Seller shall provide a written performance guarantee for the Scrubber which shall include, but shall not be limited to, process and design calculations.
- 3.1.5 The main components of the Scrubber shall include, but shall not be limited to, the following:
- A ring beam for vessel support
 - A vertical cylindrical scrubber sump vessel with a vessel skirt and associated nozzles
 - A cylindrical column above the scrubber sump vessel. The column consists of the following:
 - A packed section (which may have one or more packed beds) filled with Raschig Rings, Intalox Saddles, or other similar packing, random or structured, for offgas scrubbing
 - A distribution system for the scrubbing solution above the packed section (irrigation and recirculation)
 - A dry packing section above the packed section for the removal of fine mists
 - Wash system for the dry packing and the packed section
 - Associated nozzles
 - Lateral Restraint
- 3.1.6 Deleted
- 3.1.7 Seller shall identify all interfaces and requirements for external connections supplied by the Buyer. The type and location of interfaces shall be reviewed and approved by the Buyer prior to fabrication.
- 3.1.8 Seller shall design the Scrubber and its internals, particularly the packed sections, to meet the requirements of testing, packaging, shipping (in the vertical and horizontal positions), handling, storage, installation, and operation of the Scrubber.
- 3.1.9 Corrosion allowance is specified in the MDS and shall be applied to all surfaces exposed to process vapor or liquid.
- 3.1.10 Deleted.
- 3.1.11 Seller shall provide a report containing equipment reliability figures for all major components and sub-components of the Scrubber. The report shall be submitted to the Buyer for review per Form G-321-E of the MR. The reliability figures shall include, as a minimum, the following:
- Failure rate, or mean time between failure (whichever is available).
 - Estimated modes of failure (example, vessel failure, packing failure, nozzle failure, etc.). This may be delineated in a Failure Mode and Effect Analysis (FMEA). The method used to perform the FMEA (example, MIL-STD-1629) and the year shall be specified. All assumptions used to perform the FMEA shall be clearly stated.
 - Recommended maintenance and frequency, as applicable.
 - Estimated time to perform the recommended maintenance, as applicable.

The data above shall be based on the physical and environmental conditions delineated in this specification. Where possible, the Seller shall compare the figures for the equipment in this specification to similar equipment sold and serviced by the Seller. The source for

all estimates and any underlying assumptions shall be stated. If software is used to perform the FMEA, the Seller shall specify the software and the version used (example software, Relex, Isogen, Reliasoft, etc.).

3.2 Basic Description

The Scrubber treats the combined vent offgas collected from process vessels located in the PTF primarily to absorb Nitrogen Oxides (NO_x) gases and other acidic gases and removes large particulates from the feed gases.

The vent offgas flows up through the packed section of the Scrubber. The packed section shall be filled with either Raschig Rings, Intalox Saddles, or other similar random or structured packing, to provide efficient contact between the vent offgas and the alkaline scrubbing solution flowing down through the packed section. Part of the NO_x gases and other acidic gases, i.e. carbon dioxide, present in the vent offgas react with the alkaline scrubbing solution to form sodium salts. The scrubbing solution is collected in the scrubber sump vessel below the packed section. The pH level of the scrubbing solution shall be monitored and maintained within the operating pH limits by intermittent addition of fresh 5 molar caustic solution to the scrubber sump vessel.

The Scrubber shall remove some radioactive aerosols and reduce the radioactive particulate loading on the vessel vent High Efficiency Mist Eliminators (HEMEs) located downstream of the Scrubber. The Scrubber must achieve a decontamination factor (DF) of at least 1.8 for the removal of NO_x gases and a DF of at least 3.5 for the removal of large particulates for particulate sizes of 2 μm and larger.

The scrubber sump vessel batch volume shall be based on the sump vessel dimensions specified in the MDS and the total addition of caustic, the maximum condensate collected from contacting with the scrubber inlet offgases, and the runback volume of scrubbing solution in the event of stoppage of the vessel vent scrubber recirculation pumps. Total number of transfers per day, corresponding volume, and operating time shall be determined by Seller.

The vessel vent scrubber recirculation pumps, PVP-PMP-00001A/B (one operating, one standby), shall supply part of the scrubbing solution to the top of the packed section. The rest of the scrubber solution is recirculated back to the scrubber sump vessel to provide adequate mixing. A heat exchanger designed and provided by the Buyer will maintain the temperature of the solution recirculated to the packed section at 70 degrees F. The Buyer will provide the pumps per the Seller's confirmation of scrubbing solution flow rates and supply pressure specified on the MDS.

Demineralized water shall be added intermittently to the Scrubber, via the wash system, either to clean and reduce the operating pressure drop across the packings, or to supply makeup requirements for maintaining liquid level in the scrubber sump vessel.

The vessel vent scrubber recirculation pumps also transfer scrubbing solution to the receipt vessel, PWD-VSL-00044. This is currently planned once a day (or upon a high level condition in the scrubber sump vessel) to maintain the liquid level of the scrubber sump vessel within the operating limits. An overflow line shall be provided to accommodate overflow of the scrubber sump vessel to the plant overflow vessel, PWD-VSL-00033.

Paragraph deleted.

Outlet offgases from the Scrubber flow to the vessel vent HEMEs. The Scrubber is located upstream of the HEMEs to saturate the offgas, thus avoiding any damage to the HEME elements

from dry operation. The Scrubber shall provide for the removal of condensate and cool the offgas stream during the upset event of loss of chilled water supply.

3.3 Performance

- 3.3.1 Refer to the MDS for performance requirements and amount of NO₂ (Nitrogen Dioxide), NO (Nitric Oxide) and CO₂ (Carbon Dioxide) in the offgas inlet. Seller shall update the MDS per Form G-321-E of the MR with the required information for review by the Buyer.
- 3.3.2 Seller shall recommend additional operating parameters that must be monitored for the Scrubber to achieve the required performance.
- 3.3.3 Seller shall provide the optimum operating pH range for the scrubbing solution to achieve the required performance.
- 3.3.4 Seller shall provide the optimum operating and maximum rates of recirculation and delivery pressures of scrubbing solution for scrubbing and mixing purposes.
- 3.3.5 The Scrubber shall achieve a minimum DF of 1.8 for the removal of NO_x.
- 3.3.6 The Scrubber shall achieve a minimum DF of 3.5 for the removal of large particulates for particulate sizes of 2 µm and larger. Seller shall provide the DF for particle sizes of 1 µm and above as well as the DF for particle sizes of 0.5 µm and above.
- 3.3.7 Seller shall provide detailed operating instructions, in the form of a manual or similar, describing how to operate the Scrubber for all conditions (startup, normal, abnormal, shutdown) to achieve the required performance.
- 3.3.8 Seller shall provide the required flow rates and supply pressures of the demineralized water for wet packing and dry packing flushing.
- 3.3.9 Refer to the MDS for the maximum allowable pressure drop across the Scrubber,

3.4 Scrubber Design and Standard Details

- 3.4.1 Refer to the MDS for the dimensional constraints and design conditions of the Scrubber. Seller shall provide the outline dimensions, dry weight, test weight, and operating weight for the Scrubber in the form of a drawing or similar per Form G-321-E of the MR.
- 3.4.2 Ring beam design and fabrication shall comply with the ring beam detail in the MDS.
- 3.4.3 Nozzle design shall be in accordance with section 3.6 of Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*.
- 3.4.4 Nozzle loading and reinforcement requirements shall be in accordance with sections 3.7 and 3.8 of Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*.
- 3.4.5 Lifting lug design shall be in accordance with Buyer document # 24590-WTP-MV-M59T-00009, *Lifting Lugs Standard Details*.

- 3.4.6 Tailing lug design shall be in accordance with Buyer document # 24590-WTP-MV-M59T-00010, *Tailing Lug Standard Details*.
- 3.4.7 Grounding lug design shall be in accordance with Buyer document # 24590-WTP-MV-M59T-00012, *Grounding Lug Standard Details*.
- 3.4.8 Deleted
- 3.4.9 Seller shall provide a nameplate for the Scrubber in accordance with Buyer document # 24590-WTP-MV-M59T-00018, *Vessel Name Plate Standard Details*. General note 6 of 24590-WTP-MV-M59T-00018 does not apply.
- 3.4.10 Match mark the ring beam and the vessel skirt, using a line of welding bead, relative to north orientation after best fit.

3.5 Environmental Conditions

- 3.5.1 The Scrubber shall be stored outdoors prior to installation at ambient temperature ranging from -23°F to 113°F with relative humidity ranging from 5% to 100%.
- 3.5.2 The Scrubber will be located in room number P-0104, a Black Cell (R5-C5), at 0'-0" elevation of the pretreatment facility. The room will be maintained between 59°F dry bulb and 113°F dry bulb with an average relative humidity of 10.7%. The pressure in the room is between -1.0"WG and -1.4 "WG. Radiation dose rate is expected to be 100,000 mRad/hr.
- 3.5.3 Environment Qualification is not applicable to the PTF Vessel Vent Caustic Scrubber. The scrubber and scrubber internals are constructed from metal.

3.6 Loading

- 3.6.1 Seller shall design the Scrubber to be capable of handling the loads and stresses imposed on the Scrubber during testing, packaging, shipping (in the vertical and horizontal positions), handling, storage, installation, operation, and a Design Basis Earthquake (DBE).
- 3.6.2 Seller shall perform seismic analysis per the requirements of Buyer document # 24590-WTP-3PS-MV00-T0002, Engineering Specification for Seismic Qualification Criteria for Pressure Vessels and 24590-WTP-3PS-SS90-T0001, Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks. Refer to Section 2 of the MR for the attached In-Structure Acceleration Response Spectra.
- 3.6.3 Seller shall provide the dead weight, operating weight, and center of gravity for the column section, sump vessel, and the entire Scrubber per Form G-321-E of the MR.
- 3.6.4 Seller shall provide the base reaction (with seismic load combinations) of the Scrubber per Form G-321-E of the MR.

3.7 Instrumentation and Control Requirements

- 3.7.1 Seller shall recommend instrumentation and controls required for the Scrubber to achieve its required performance.
- 3.7.2 Seller shall provide functional test set points and recommended operating set points for the Scrubber.
- 3.7.3 Seller shall design, fabricate and install the necessary components for Buyer supplied and installed instrumentation. The components include, but are not limited to, thermowells, dip legs, dip pipes, and nozzles.
- 3.7.4 Thermowell design shall be in accordance with Buyer document # 24590-WTP-MV-M59T-00007, *Thermowell Connection Standard Details*.
- 3.7.5 Scrubber connection design shall be in accordance with Buyer document numbers 24590-WTP-MV-M59T-00016001, *Vessel Connections Standard Details Sheet 1 of 3*, and 24590-WTP-MV-M59T-00016002, *Vessel Connections Standard Details Sheet 2 of 3*.

3.8 Accessibility and Maintenance

- 3.8.1 The Scrubber will not be accessible for maintenance once it is put in operational service. Seller shall consider and recommend all necessary features to ensure the Scrubber does not fail for a minimum service life of 40 years.
- 3.8.2 Seller shall design and install a wash system to clean the dry packing and packed section as and when required. Seller shall recommend the frequency and period of cleaning as preventive maintenance for the given duty conditions. The wash system will be supplied with demineralized water.

3.9 Lateral Restraint for scrubber at elevation 41'-6"

- 3.9.1 The Buyer will provide embeds at 41'-6" elevation to support the use of a lateral restraint to reduce the bending moments in the upper column, to lower vessel junction and to reduce moments at the base. The seller shall design, fabricate, and inspect the lateral restraint.
- 3.9.2 The lateral restraint shall be designed in accordance with 24590-WTP-DC-ST-01-001, Structural Design Criteria and 24590-WTP-DC-ST-04-001, Seismic Analysis and Design Criteria.
- 3.9.3 This specification section takes precedence over section 1.3, "Analysis and design of equipment/ tank supports to be furnished by the Buyer", 24590-WTP-3PS-SS90-T0001, Engineering Specification for Seismic Qualification of Seismic Category I / II Equipment and Tanks.
- 3.9.4 The seller shall provide a calculation for the lateral restraint including: loads on the embed plate, size of field weld at the embed plate, and sizing of the lateral restraint support members.

- 3.9.5 The lateral restraint design shall take in to account the Relative Displacement values specified in attachment 5 of the Material Requisition.
- 3.9.6 The lateral restraint design shall include field trim or adjustability to account for the vessel elevation and wall construction tolerances.
- Vessel construction elevation tolerance is; plus 0 inches, minus 1/4 inches
 - Vessel location with respect to the black cell walls is; plus or minus 1 inch

Seismic Anchor Motion (SAM).

- 3.9.7 Provide the following information in the seismic report for the Vessel Vent Caustic Scrubber:
- For nozzles which are currently modeled in the finite element model the x, y and z displacements at the nozzle / shell / head intersection. The coordinates x, y and z are to be aligned with or referenced to the plant coordinate system identified on your fabrication drawings.
 - For nozzles not currently modeled in the finite element model the same information is required as above.
 - Stiffness coefficients for each nozzle currently modeled in the finite element model. Stiffness coefficients shall be reported as follows:
 - Cylindrical shell mounted nozzles
 - In plane shall be presented as longitudinal plane
 - Out plane shall be represented as circumferential plane
 - Torsional
 - Spherical shell (head) mounted nozzles
 - In plane shall be presented as meridional plane
 - Out plane shall be presented as latitudinal plane
 - Torsional

4 Materials

4.1 General

- 4.1.1 All materials of construction for the Scrubber shall conform to the requirements of:
- this specification
 - Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*
 - Buyer document # 24590-WTP-3PS-G000-T0002, *Specification for Positive Material Identification*
 - the MDS
 - the MR
 - ASME AG-1-1997 Article AA-3000, *Code on Nuclear Air and Gas Treatment*
- 4.1.2 Seller shall provide Material Safety Data Sheets (MSDSs) for all applicable materials used in the construction of the Scrubber.
- 4.1.3 All materials used in the construction of the Scrubber shall be resistant to the radiation dose rate indicated in section 3.5 of this specification.

- 4.1.4 The lateral restraint shall be stainless steel in accordance with section 7.1.2, 24590-WTP-DC-ST-01-001, Structural Design Criteria.

4.2 Prohibited Materials

- 4.2.1 Mercury and other low melting point metals, their alloys, or materials containing such metals as their basic constituents shall not be used in the construction of the Scrubber.
- 4.2.2 Sulfides and halides shall not be used in direct contact with stainless steel.
- 4.2.3 Asbestos shall not be included in any component of the Scrubber.
- 4.2.4 Carbon steel shall not be included in any component in contact with fluid and the vessel.
- 4.2.5 Halide containing materials shall not be used in any component of the Scrubber.

5 Fabrication

5.1 General

- 5.1.1 Fabrication of the Scrubber shall conform to the requirements of:
- this specification
 - Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*
 - the MR
 - ASME AG-1-1997 Article AA-6000, *Code on Nuclear Air and Gas Treatment*
- 5.1.2 Fabrication tolerances shall conform to the requirements of ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*, and Buyer document # 24590-WTP-MV-M59T-00001, *Pressure Vessel Tolerances Standard Details*.
- 5.1.3 End preparations of field butt welds shall be in accordance with Buyer document # 24590-WTP-PW-P30T-00001, *WTP End Prep Detail for Field Butt Welds*.

5.2 Welding

- 5.2.1 Welding of the Scrubber shall conform to the requirements of the documents listed in section 5.1.1 of this specification and Buyer document # 24590-WTP-3PS-MVB2-T0001, *Specification for Welding of Pressure Vessels, Heat Exchangers and Boilers*.
- 5.2.2 Welding of structural steel shall conform to the requirements of Buyer document # 24590-WTP-3PS-SS00-T0002, *Specification for Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*.

6 Tests and Inspections

6.1 General

- 6.1.1 Seller shall conduct and be responsible for all testing and inspections of the Scrubber per the requirements of:
- this specification
 - ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, *Rules for Construction of Pressure Vessels*
 - Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*
 - the MR
 - ASME AG-1-1997 Article AA-5000, *Code on Nuclear Air and Gas Treatment*
- 6.1.2 Nondestructive Examination requirements shall be in accordance with sections 6.1, 6.2, and 7.2 of Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*.
- 6.1.3 Seller shall develop and submit detailed test and inspection procedures for conducting all testing and inspections required per this specification, applicable codes, standards, and reference documents for review by the Buyer prior to fabrication of the Scrubber.
- 6.1.4 Seller shall complete and submit reports of all testing and inspections. Reports shall identify the component tested or inspected, date performed, applicable procedures, acceptance criteria, person performing the test or inspection, results, and conclusions. Drawings of test setups shall be included. All testing and inspection results shall be certified.
- 6.1.5 Control and calibration of measuring and test equipment shall be in accordance with ASME AG-1-1997 Article AA-5130, *Code on Nuclear Air and Gas Treatment*.
- 6.1.6 Nondestructive Examination for the ring beam shall meet the additional requirements of ANSI/AISC N690, section 11, 24590-WTP-3PS-SS00-T0002, *Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*. All ring beam welds are considered critical welds. Section 11 is mandatory even if the web to flange weld NDE is not indicated on a drawing.
- 6.1.7 Nondestructive Examination for the lateral restraint shall meet the additional requirements of ANSI/AISC N690, section 11, 24590-WTP-3PS-SS00-T0002, *Welding of Structural Stainless Steel and Welding of Structural Carbon Steel to Structural Stainless Steel*.

7 Preparation for Shipment

7.1 General

- 7.1.1 The Scrubber shall be prepared for shipment in accordance with:
- Buyer document # 24590-WTP-3PS-MV00-T0001, *Engineering Specification for Pressure Vessel Design and Fabrication*

- Buyer document # 24590-WTP-3PS-G000-T0003, *General Specification for Packaging, Shipping, Handling and Storage Requirements*
- ASME AG-1-1997 Article AA-7000, *Code on Nuclear Air and Gas Treatment*

7.1.2 All results of shop tests and inspections for the Scrubber shall be reviewed by the Buyer prior to preparing and packaging it for shipment.

7.1.3 Seller shall verify, by calculation, that the Scrubber and its internals will withstand loads occurring during shipping, handling and installation.

7.2 Tagging

7.2.1 All packages shall be clearly and suitably tagged to at least show the Seller's name, Buyer's name, plant item number, purchase order number, package contents, parts list (for each package), and handling instructions.

7.2.2 The Scrubber shall be identified using a nameplate as specified in section 3.4.9 of this specification.

7.3 Shipping, Handling and Storage Instructions

Seller shall submit shipping weights as well as detailed shipping, handling, and storage instructions for the Scrubber prior to its shipment per Form G-321-E of the MR.

8 Quality Assurance

8.1 General Requirements

8.1.1 Seller's Quality Assurance Program (QAP) requirements are specified in Buyer document # 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.1.2 Seller's QAP manual shall be submitted to the Buyer for review in accordance with Buyer document # 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.1.3 Seller's QAP, as a minimum, shall contain the requirements detailed in the Supplier Quality Assurance Program Requirements data sheet listed in section 2 of the MR.

8.2 Quality Related Components

8.2.1 Seller shall have in place a QAP meeting the requirements of ASME-NQA-1-1989, marked as applicable in Supplier Quality Assurance Program Requirements Data Sheet attached to the MR, and Buyer document # 24590-WTP-3PS-G000-T0001, *General Specification for Supplier Quality Assurance Program Requirements*.

8.2.2 The successful bidder must pass a pre-award survey by the Buyer. Seller shall demonstrate that its quality program is in compliance with the procurement quality

requirements listed in the Supplier Quality Assurance Program Requirements Data Sheet. Seller shall allow the Buyer, its agents, and DOE access to their facility and records pertaining to this purchase order for the purpose of QA audits and surveillance at mutually agreed times.

- 8.2.3 All items shall be manufactured in accordance with Seller's QAP that meets the requirements of ASME NQA-1-1989, and has been previously evaluated and accepted by the WTP Quality Assurance Organization.
- 8.2.4 Seller shall submit their QAP and work plan to the Buyer for review prior to commencement of work. The plan shall include documents and procedures to implement the work and include a matrix of essential QA elements cross referenced with the documents or procedures.

9 Configuration Management

- 9.1 The equipment covered by this specification is identified with the plant item number shown in the MDS. The equipment shall be identified in accordance with section 7.2, Tagging, of this specification.
- 9.2 Substitutions and deviations shall be in accordance with section 2.6 of the MR.

10 Documentation and Submittals

10.1 General

- 10.1.1 Seller shall submit to Buyer all detailed designs, documentation, procedures, instructions, calculations, analyses, manufacturer data, inspection reports, test reports, certifications, certificates, manuals, MSDSs, and drawings required per this specification, its addenda and attachments, the MR, and referenced codes, standards and Buyer documents.
- 10.1.2 Seller shall submit to Buyer the Engineering and Quality Verification documents in the forms, quantities, and timing shown in Form G-321-E, *Engineering Document Requirements*, and Form G-321-V, *Quality Verification Document Requirements*, in section 3 of the MR.
- 10.1.3 Section 2.6 of the MR applies for substitutions and deviations.
- 10.1.4 Each documentation transmittal package shall have a documentation inventory sheet attached listing all documents and the number of pages in each.
- 10.1.5 The seller shall submit to the buyer all detail designs, documentation, calculations, analysis, inspection reports, test reports, certifications, certificates, and shop detail drawings for the lateral restraint.

10.2 Calculations

All calculations to be provided to the Buyer shall be orderly, complete, and sufficiently clear to permit verification. The body of the calculations shall include:

- a concise statement of the purpose of the calculation
- input data, applicable criteria, and stated assumptions
- a list of references used, including drawings, codes, standards, and computer programs (indicate the version or issue date)
- a discussion of rationale used for design assumption basis
- equations used for all computations
- numerical calculations including identification of units used
- a concise statement addressing the calculation results and/or recommendations
- a table of contents for complex calculations

10.3 Schedules

10.3.1 A detailed schedule of engineering, document submittals, material purchases, fabrication, shop tests, and shipment shall be submitted using Form 15EX in section 3 of the MR.

10.3.2 Deleted